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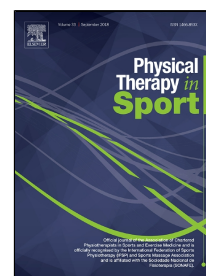
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# Accepted Manuscript

Epidemiology of Injury in English Professional Football Players: a cohort study

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**TITLE:****Epidemiology of Injury in English Professional Football Players: a cohort study**

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**ABSTRACT**

*Objective:* To estimate the current incidence and location of injury in English professional football.

*Design:* Prospective cohort study conducted over one competitive season (2015/16).

*Setting:* Professional football players competing in the English Football League and National Conference.

*Participants:* 243 players from 10 squads ( $24.3 \pm 4.21$  per squad).

*Main Outcome Measure:* Injury incidence, training and match exposure were collected in accordance with the international consensus statement on football injury epidemiology.

*Results:* 473 injuries were reported. The estimated incidence of injury was, 9.11 injuries/1000h of football related activity. There was a higher incidence of injury during match play (24.29/1000h) compared to training (6.84/1000 hours). The thigh was the most common site of injury (31.7%), muscle strains accounted for 41.2% of all injuries. The hamstrings were the most frequently strained muscle group, accounting for 39.5% of all muscle strains and 16.3% of all injuries. Moderate severity injuries (8-28 days) were the most common (44.2%).

*Conclusions:* Incidence of injury has increased over the last 16 years with muscle strains remaining the most prevalent injury. The hamstrings remain the most commonly injured muscle group.

## **INTRODUCTION**

Lower incidence of injury and higher player availability are associated with higher points totals in European football leagues (Hägglund et al., 2013). The English Football League (EFL) is the largest professional football league in the world generating over £1.6 billion in television rights from the premier division alone (Elliott, 2016; Forrest & Simmons, 2006). Since 1989 there has been a paucity of research reporting estimates of the incidence and prevalence of injury in English Professional Football (Hawkins, Hulse, Wilkinson, Hodson, & Gibson, 2001). However, the last large scale epidemiological study in which English Professional Football clubs were investigated solely was published in 2001. Furthermore, contemporary studies have reported an increase in physical demands of English football, with running and sprinting distances increasing by 30-35% over a 7-year period (Barnes, Archer, Hogg, Bush, & Bradley, 2014). The value of epidemiological studies of injury is that they allow the efficacy of therapeutic or organisational interventions to be evaluated. This helps researchers and clinicians to focus time and resources toward injuries where intervention is most needed.

At present the musculoskeletal issues of greatest concern in English professional football are unknown. Whilst knowledge of European cohorts provides a useful start point for clinicians and researchers, there are some fundamental differences in conditions for players based in mainland Europe that include but are not limited to the weather, intensity of match play and perhaps most notably, the winter break. The aim of this study is to provide an updated estimate of the incidence and prevalence of injury in English Professional Football.

## **MATERIALS AND METHODS**

### **Participants, Recruitment and Selection**

Following ethical approval, a prospective cohort study was designed. Participants were male professional footballers, signed to the English Football League (EFL) or clubs competing in the English National Conference during the 2015-16 season.

## Procedure

Guidelines set out in the Union of European Football Associations (UEFA) Consensus Statement were used to determine injury, recurrent injury, severity of injury and exposure (Ekstrand, Hagglund, & Walden, 2011; Fuller et al., 2007). A time loss definition of injury was used where any physical complaint sustained by a player that resulted from a football game or football based training session and prevented them from being able to take part in future football training or match play. Injuries that were sustained in non-football related activities were not recorded (Fuller et al., 2007). A recurrent injury was defined as an injury to the same site and categorised as the same type, after the player had returned to full participation following initial injury. A recurrent injury was classified as early recurrence (less than 2 months following initial injury), late recurrence (2-12 months following initial injury) and delayed recurrence (greater than 12 months following initial injury) (Fuller et al., 2007). The severity of injury was defined as the total number of days from the date of injury and the date of the player's full participation in football related training or match play. Injuries were categorised as follows: slight (1-3 days absence), minor (4-7 days absence), moderate (8-28 days absence) or major (more than 28 days absence). The club medical team made a diagnosis of injury or recurrent injury.

Exposure was recorded to the nearest minute using Global Positioning Systems (GPS) or manual staff records. Total exposure was calculated as the sum of all match and training exposure. Match exposure was classified as competitive game play between teams from different clubs, whilst training exposure was classified as physical activities involving individuals or groups of players that were under the guidance of coaching or fitness staff (Fuller et al., 2007). Absence due to sickness or other circumstances were not recorded.

## Data Analysis

Data analysis was conducted using SPSS for Windows version 24 (SPSS Inc. Chicago, Illinois) with statistical significance set at  $p < 0.05$ . The incidence of injuries was calculated per 1000 hours of exposure with 95% CI's (total, training & match). The  $\chi^2$  was used to compare categorical variables within each section.

## **RESULTS**

A total of two hundred and forty-three players participated from 10 squads, an average of  $24.3 \pm 4.21$  per squad. Injury incidence and exposure were monitored throughout the season (July 2015-May 2016). Four hundred and seventy-three injuries were sustained in total providing a clinical incidence of 1.9 injuries per player. In total, 56075 hours of exposure (46351 of training and 9724 of match play) were recorded across the season. The total incidence of injury was 9.11 injuries/1000h of exposure (CI 6.48-12.87). Participants sustained a higher incidence of injury in match play (24.29 injuries/1000h, 95% CI 19.92-28.65) than during training (6.84 injuries/1000h, 95% CI 3.98-9.70) with a mean difference of 17.44 injuries/1000h (95% CI 12.48-22.40,  $P < .001$ , paired  $t$  test). Figure 1 illustrates the monthly distribution of injuries in training and match play. The highest incidence of match play and training injuries was observed in December (32.56/1000h and 19.3/1000h respectively). A total of 9189 training and/or match days were missed as a result of injury across all clubs.

### **Site of Injury**

Lower limb injuries accounted for 64.2% (CI 55.3% to 64.1%, 304/473). The thigh region was the most common site of injury 31.7% (CI 27.6% to 36%, 150/473). The knee (14.6%, CI 11.6% to 18%, 69/473) and ankle (13%, CI 10.7% to 16.9%, 40/473) were recorded as the second and third most prevalent sites of injury. Figure 2 illustrates the site of injury incidence. The  $X^2$  value of 75.3, DF=2 was found to have an associated probability value of  $P < 0.001$ .

### **Type of Injury**

Muscle strains accounted for 41.2% (CI 36.8% to 45.7%, 195/473) of all injuries, followed by sprains (17.1%, CI 13.9 to 20.7%, 81/473) and blunt soft tissue trauma (haematoma's) (13.7%, CI 10.9% to 17.1%, 65/473). This is illustrated in figure 3. The  $X^2$  value of 88.4, DF=2 was found to have an associated probability value of  $P < 0.001$ .

Thigh muscle strains were the most commonly injured region, (26%, CI 22.2% to

30.1%). The hamstring was the most frequently strained muscle group, accounting for 39.5% (CI 32.9% to 46.4%) of all muscle strains and 16.3% (CI 13.2% to 19.8%) of all injuries. This was followed by groin strains (25.6% CI 20% to 32.2%, 11% CI 8.1% to 13.7%) and quadriceps strains (15.4% CI 10.9% to 21.1%, 6% CI 4.4% to 8.9%). Of the seventy-seven hamstring strains sustained, 51.9% (CI 40.3% to 63.5%) were sustained during match play and of these 62.3% (CI 50.6% to 73.1%) were classified as moderate in severity (8-28 days injured). A total of 27.3% (CI 17.7% to 38.6%) were recurring hamstring strains. Within the fifty groin strains recorded, 64% (CI 49.2% to 71.1%) occurred during match play and 50% (CI 35.5% to 64.5%) were of moderate severity. A total of 20% (CI 10% to 33.7%) were recurring injuries to the groin muscle group. 73.3% (CI 54.1% to 87.7%) of quadriceps strains occurred during training and 46% were of minor in severity (CI 28.3% to 65.7%) 10% (CI 0.21% to 26.5%) of quadriceps strains were classified as re-injuries.

### **Mechanism of Injury**

The estimate of prevalence of at least one traumatic injury was 60% (CI 55.5% to 64.3%, 284/473). Chronic overuse injury mechanisms accounted for the remaining 40% (CI 35.6% to 44.4%, 189/473). Recurring injuries accounted for 16.9% (CI 13.8% to 20.5% 80/473) of all injuries.

### **Severity of Injury**

The estimate of prevalence of moderate injury was 44.1% (CI 39.7% to 48.6%, 209/473), for minor (35.9%, CI 31.7% to 41.6% 170/473), major (15%, CI 12% to 18.5%, 71/473) and slight (4.7%, CI 3% to 6.9%, 22/473). This can be seen in table 1. The  $X^2$  value of 189.9, DF=3 was found to have an associated probability value of  $P < 0.001$ .

### **DISCUSSION**

This was the first study in over sixteen years to report incidence and prevalence of injury in English male professional football players. Injury incidence and recurrent injuries have both increased. Consistent with the previous audit and



more recent epidemiological studies across Europe, muscles in the thigh region, particularly the hamstring muscle group, were most commonly injured.

The overall injury incidence in our study of English professional footballers was greater than that reported in Europe (9.11 injuries/1000h vs. 8.0/1,000h) (Ekstrand et al., 2011). Our match play injury incidence results appear to approximate those observed in Southern Europe (24.2 injuries/1000h vs. 25.7/1000h). However, training incidences were reported at around half of our reported frequency (6.8/1000h vs. 3.5/1000h) (Waldén, Hägglund, Orchard, Kristenson, & Ekstrand, 2013).

Previous findings from Northern Europe suggest a slightly greater match injury incidence (27.5 vs. 24.2/1000h, 12.8%) and lower training injury incidence (4.1 vs. 6.8/1000h, 49.6%) compared to our findings (Hägglund, Waldén, & Ekstrand, 2006; Waldén et al., 2013). However, clubs involved in both of these studies were only competing in the top league within their domestic competition. In comparison, our study included clubs competing in the four leagues below the English Premier League. This difference in competition level may lead to variances in financial support for medical staff and equipment (Ekstrand et al., 2011). Our results reported an average squad size of 24.3 players. Smaller squads of players are also exposed to higher rates of match and training exposure throughout a typical season, which has been linked to an increase in injury incidence (Ekstrand, Waldén, & Hägglund, 2004; Hawkins et al., 2001). Spikes in injury incidence during our study mirror periods of the English season which are known to be associated with higher training volume or fixture congestion (Figure 1) such as pre-season (July-August) and Christmas (December). A similar trend has previously been reported in English football (Hawkins & Fuller, 1999). The explanation for these trends in injury incidence is plausible but without details of individual player exposure remain speculative. It is difficult to comment further on the role of exposure in the injury data reported due to this limitation.

The patterns of injury location and type reported in our study are consistent with both previous English (Hawkins & Fuller, 1999; R. Hawkins et al., 2001) and European injury audits (Ekstrand et al., 2011). The rise in hamstring strains (~4%) appear to mirror that reported in Europe between 2001 – 2014 (Ekstrand, 2016). The creation of injury prevention programmes during this timeframe has aimed to reduce injury incidence. However, training programmes, such as the FIFA 11+ are not enforced or used consistently (Bahr, Thorborg, & Ekstrand, 2015), with differences in training philosophies and coaches leadership styles at individual clubs often dictating the loading and injury prevention schedule, leading to a subsequent variance in injury incidence (Ekstrand, 2016; Ekstrand et al., 2017; Malone et al., 2017).

Recurring injury was higher than previous English clubs performing across multiple professional leagues (17% vs. 7%) (Hawkins et al., 2001). This change over the last 16 years could also be attributed to the higher number of fixture demands across all English football leagues. Previous epidemiological studies that have only included teams in the English Premier League (Lundblad, Waldén, Magnusson, Karlsson, & Ekstrand, 2013), which as a competition includes a lower number of competitive matches compared to the EFL and National Conference (48 vs. 40 league matches 18% increase). Cup competitions with an increased number of rounds for football league teams also add fixture congestion. Bengtsson *et al.*, (2013) reported a direct association between periods of fixture congestion and muscle injury, when comparing  $\leq 4$  days to  $\geq 6$  days of recovery between competitive matches. However, it must be noted that this study used a clear injury definition for recurring (re-injury), where as the previous multi-league English study did not disclose any definition. In English professional football players, we reported moderate injuries (8-28 days) occurred most often, in line with previous findings that utilised identical timeframes and definitions of injury severity (Ekstrand et al., 2011; Waldén et al., 2013). These findings are in agreement with those of Hawkins et al., (2001) who reported an average of 4.0 matches were missed due to injury, which would be played within an 8-28 day timeframe .

This is the first study in over 16 years to collect injury data solely from teams across English professional football leagues. Published consensus statements on definitions and collection methods were used during data collection. However, it must be noted that the 10 clubs each had a different gatekeeper, which may have led to variance in the data being reported. Furthermore, match and training exposure data was collated from various sources such as software, match reports and coaches records. Individual player exposure recorded solely via global positioning systems (GPS) and an estimate of the internal training load (i.e. rate of perceived exertion) arising from that exposure would greatly advance knowledge in the field.

Our findings report injury incidence and recurrent injury have increased since the previous epidemiological study of English professional football players. Therefore, football staff should consider looking at current practices around suggested risk factors such as coaching philosophy, previous injury and load management (Ekstrand et al., 2017; Hägglund et al., 2006; Malone et al., 2017), in order to reduce the incidence and prevalence of injury over subsequent seasons.

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**CONFLICTS OF INTEREST**

None declared.

**ETHICAL STATEMENTS**

This project received ethical approval from the Leeds Beckett Local Research Ethics committee.

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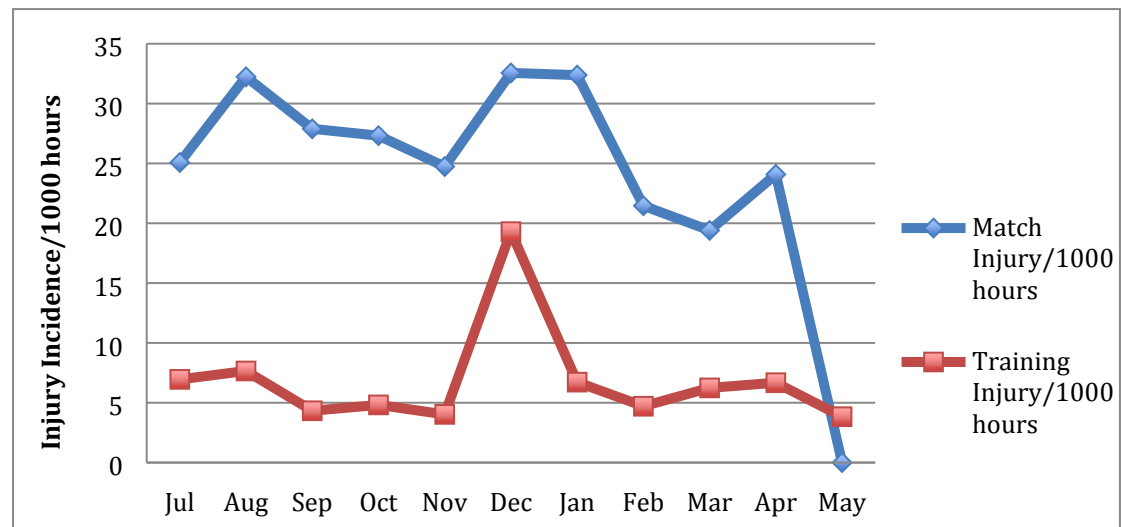
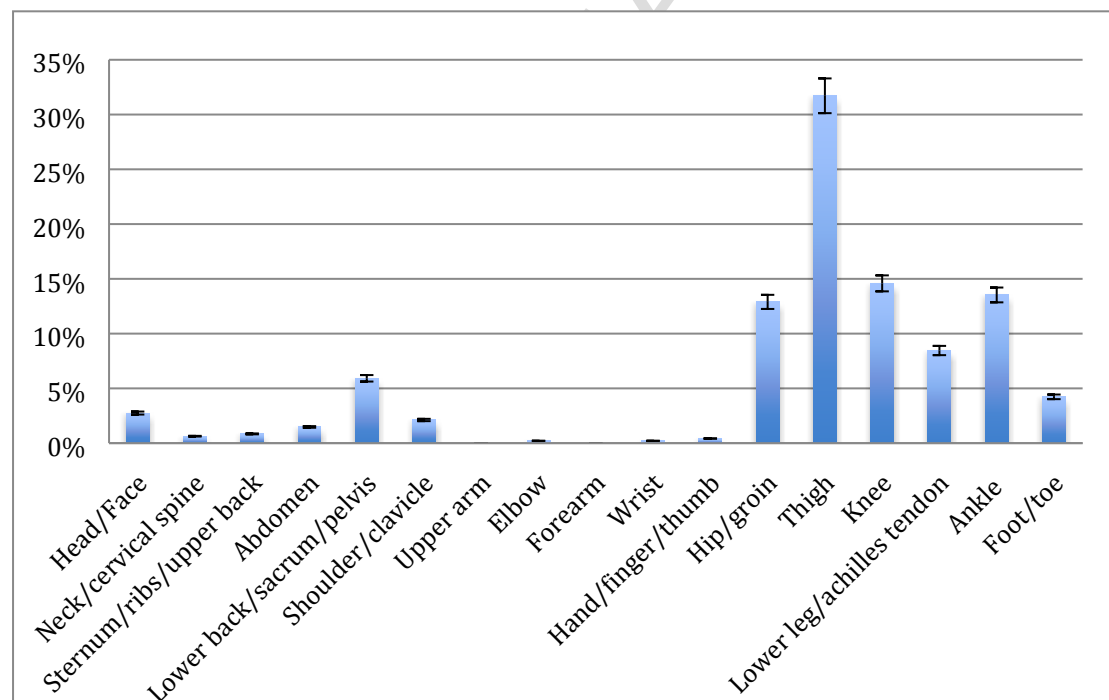
**KEY TERMS**

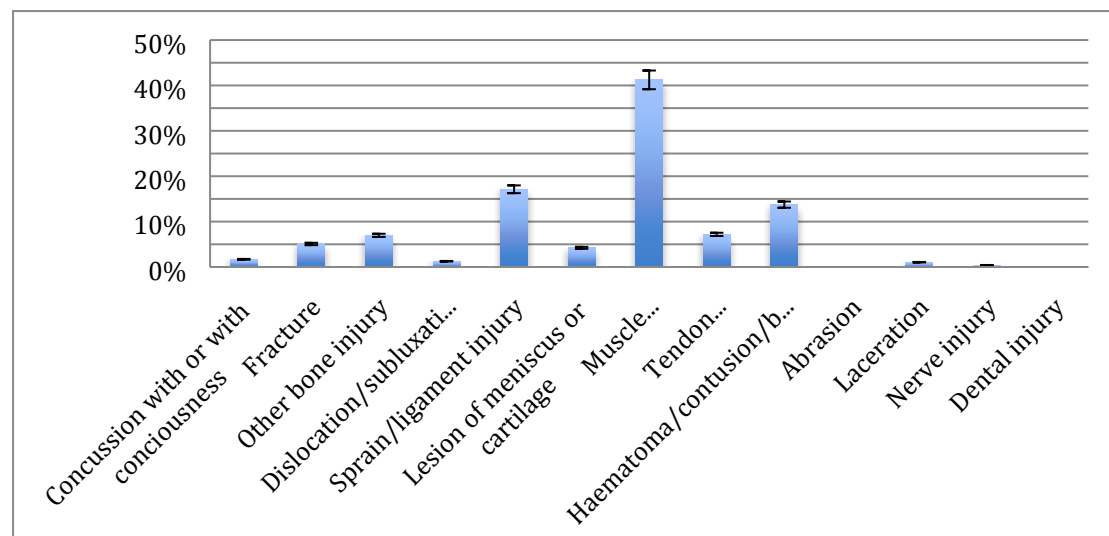
Epidemiology, Audit, Injury, Football, Muscle

**HIGHLIGHTS**

- Previous epidemiological studies, using top-level European cohorts, have reported muscle injury to be the highest in incidence and prevalence in professional male football players.
- This study is designed to provide an update on current epidemiological figures in elite football players, competing across all professional English leagues. The last study to consider this cohort was published in 2001.
- The reported findings will serve to influence medicine and science staff in decision making of injury prevention strategies and procedures.



**Figure 1. Incidence of match and training injury/1000h across the season****Figure 2. Injury Location**

**Figure 3. Injury Type****Table 1. Injury severity totals/1000 hours.**

Injury Severity /1000 hours	
Severity	n/1000 hours (%)
Slight (1-3 days)	0.4 (4.7%)
Minor (4-7 days)	3.5 (35.9%)
Moderate (8-28 days)	4 (44.2%)
Major (>28 days)	1.3 (15%)